Conclusions

The above results lead to the conclusion that UV radiation at levels normally encountered in arid areas are sufficiently high to be the most common cause of SI and at least a substantial contributor to development of VTB in cantaloupes. In severe cases of SI, in which the flesh is injured ("cooked"), excessively high temp obviously is a contributing factor, because UV generally does not penetrate deeply into plant tissue (17) and particularly not through corky tissue (11). These results also permit distinguishing between symptoms of SI induced by shortwave and longwave components of solar radiation. Since covering melons with plastic UV filters obviously is commercially impractical, breeding completely and heavily netted cantaloupes and whitewashing them when a good cover of foliage is absent (9) would minimize UV-induced defects in areas with high radiation levels, such as the Central Valley of California and the deserts of California and Arizona (18).

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Effect of Fertilizer Applications on Yield of Rabbiteye Blueberries[1]

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Abstract. **Rabbiteye blueberries (*Vaccinium ashei* Reade, cvs. Tifblue and Woodard) were fertilized with various ratios of nutrients for 6 years. 'Tifblue' responded to 4–8–8 (4.0 N–3.5 P–6.6 K), 5–10–10 (5.0 N–4.4 P–8.3 K), and cottonseed meal 7–2–2 (7.0N–0.9P–1.7K). 'Woodard' did not respond to any fertilizer.**

Fertilizer recommendations vary greatly in the various blueberry growing areas in the U. S. The trend seems to be toward a 1–1–1 ratio (oxide basis) at rates that should give 33.6 to 55.0 kg of N per ha per year (9). Specific recommendations also vary within soil type, fertilizer type, and sampling technique. A complete fertilizer (N–P–K) on lowbush blueberry plants in Maine generally gave taller stems with more fruit buds than either no fertilizer or nitrogen alone (20). Nutrient deficiency studies indicate that N deficiency appeared first (14, 15, 17).

Ballinger and Goldston (6) reported that leaves of blueberry plants in eastern North Carolina appeared nutrient deficient after harvest, thus implying the need for additional postharvest application of fertilizers. On the other hand, Townsend (19) suggested that the highbush blueberry has a low fertilizer requirement, and Ballinger (3) reported that the highbush blueberry is extremely sensitive to excessive quantities of fertilizer. Experiments using sand culture (8, 10) and peat (10) indicate that blueberries absorb ammonium better than nitrate N at high pH, while Hammett and Ballinger (12) indicated that highbush blueberries could use either NH_4 or NO_3 N if the pH is within 6.2 or under.

A 4–8–4 (4.0 N–3.5 P–3.3 K) analysis was used on rabbiteye types in Florida at 560 to 897 kg per ha with the N source being ammonium sulfate (18). Rabbiteye blueberry plantings have responded to applications of 4–8–4 (4.0 N–3.5 P–3.3 K), 4–8–6 (4.0 N–3.5 P–5.0 K), and 4–8–8 (4.0 N–3.5 P–6.6 K) fertilizers in Florida (5).

This study was conducted to gain information for advising rabbiteye blueberry growers of their fertilizer needs.

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[3]Urea-form, trade name Uramite.

Table 1. Fertilizer applications to 'Tifblue' and 'Woodard' blueberry plants.

N–P–K oxide ratio	Fertilizer applied (kg N–P–K/ha)					
	1959	1961	1962	1963	1964	1965
7–2–2[z]	14–1.8–3.3	11.2–1.4–2.7	29.6–3.3–6.2	29.6–3.3–6.2	59.2–7.4–14	118.4–14.9–28.1
1–2–2[y]	14–12.3–23.2	11.2–9.9–18.6	29.6–26–49.1	29.6–26–49.1	59.2–52.1–98.3	118.4–104.2–196.5
1–2–2[x]	14–12.3–23.2	11.2–9.9–18.6	29.6–26–49.1	29.6–26–49.1	59.2–52.1–98.3	118.4–104.2–196.5
0–0–0	0–0–0	0–0–0	0–0–0	0–0–0	0–0–0	0–0–0
1–0–0	14–0–0	11.2–0–0	29.6–0–0	29.6–0–0	59.2–0–0	118.4–0–0
0–1–0	0–12.3–0	0–4.9–0	0–11.8–0	0–11.8–0	0–23.6–0	0–47.2–0
0–0–1	0–0–23.2	0–0–9.3	0–0–22.3	0–0–22.3	0–0–44.6	0–0–89.2
1–1–1	14–6.2–11.6	11.2–4.9–9.3	29.6–11.8–22.3	29.6–11.8–22.3	59.2–23.6–44.6	118.4–47.2–89.2
2–1–1	28–6.2–11.6	22.4–4.9–9.3	59.2–11.8–22.3	59.2–11.8–22.3	118.4–23.6–44.6	236.8–47.2–89.2
1–2–1	14–12.4–11.6	11.2–9.8–9.3	29.6–23.6–22.3	29.6–23.6–22.3	59.2–47.2–44.6	118.4–94.4–89.2
1–1–2	14–6.2–23.2	11.2–4.9–18.6	29.6–11.8–44.6	29.6–11.8–44.6	59.2–23.6–89.2	118.4–47.2–178.4
2–2–2	28–12.4–23.2	22.4–9.8–18.6	59.2–23.6–44.6	59.2–23.6–44.6	118.4–47.2–89.2	236.8–94.4–178.4

[z]Cottonseed meal.

[y]5–10–10 commercial fertilizer.

[x]4–8–8 azalea-camellia fertilizer.

Materials and Methods

One-year-old nursery plants of 'Woodard' and 'Tifblue' rabbiteye blueberries (*Vaccinium ashei*) were set 1.2 × 3.0 m in a Leefield loamy sand soil in March 1959. Single rows of 'Woodard' were alternated with double rows of 'Tifblue' for cross pollination.

A split-plot design was used with the 'Tifblue' plants. The main plots consisted of 3 replications and 2 methods of fertilizer placement, under or to the side of each of 4 plants per plot. Under applications were made prior to planting in March 1959, and side applications were made in May 1959. New shoot growth in early May 1959 averaged 10.2 mm. Sub-plots, each of 4 plants/plot, consisted of 12 fertilizer treatments (Table 1).

In 1959 the custom-made 1–1–1 ratio (oxide basis) fertilizer treatments consisted of 14 kg N, 6.2 kg P and 11.6 kg K per ha. Sources were ammonium nitrate, superphosphate and potassium sulfate. Cottonseed meal [7–2–2 (7.0 N–0.9 P–1.7 K)], azalea-camellia fertilizer 4–8–8 (4.0 N–3.5 P–6.6 K), and commercial grade 5–10–10 (5.0 N–4.4 P–8.3 K) (1% NO_3–N) were applied to give 14 kg N/ha.

Dead plants (see Results) were replaced in 1960; therefore, all fertilizer treatments were omitted that year. All fertilizer treatments each year, thereafter, were applied in March. Fertilizer applied in 1961 was reduced to give 11.2 kg N, 4.9 kg P and 9.3 kg K/ha. Other treatments as seen in the tables consisted of none or double this amount. The pre-mixed formulations were applied to give 11.2 kg N/ha.

Beginning in 1962, sources of N in the various fertilizer treatments were evaluated. Main plots were reorganized to give 2 replications of each: ammonium nitrate, urea-form[3] and urea. In 1962 and 1963 the rates for N, P and K in the custom-made fertilizer were increased to 29.6, 11.8 and 22.3 kg/ha, respectively. The pre-mixed fertilizers were increased to give 29.6 kg N/ha. These rates were doubled in 1964 and were quadrupled in 1965 (Table 1).

Soil samples from each of the test plots were taken on April 23, 1965 and tested for pH, P and K. Plant vigor, type of growth and foliage color were rated 1 to 10 in May 1965.

Yield records were made from 1961 to 1966. 'Woodard' was generally harvested 7 days earlier than 'Tifblue'.

Table 2. Effect of fertilizer placement on the percent of 'Tifblue' and 'Woodard' plants killed.[z]

N–P–K oxide ratio[y]	Dead plants (%)			
	Fertilizer placement			
	Side		Under	
	Tifblue	Woodard	Tifblue	Woodard
7–2–2[x]	8.3	0	16.7	25.0
1–2–2[w]	0	0	50.0	100.0
1–2–2[v]	0	0	16.7	50.0
0–0–0	0	0	0	0
1–0–0	0	0	33.3	0
0–1–0	0	0	8.3	0
0–0–1	0	0	0	0
1–1–1	0	0	25.0	25.0
2–1–1	0	25.0	33.3	100.0
1–2–1	0	0	8.3	50.0
1–1–2	0	25.0	8.3	25.0
2–2–2	0	25.0	50.0	25.0

[z]Dead plants replaced March 1960.

[y]N, P, K sources – ammonium nitrate, superphosphate, potassium sulfate.

[x]7–2–2 Cottonseed meal.

[w]5–10–10 oxide percentage.

[v]4–8–8 Azalea-camellia fertilizer.

Results

Higher percentage of 'Tifblue' and 'Woodard' plants died when fertilizer was placed directly under the plants (Table 2). However, no 'Woodard' plants died when inorganic N was not applied. In general, 'Woodard' was more susceptible to fertilizer placement injury.

Yield in 1961 was not affected by location of fertilizer placement (data not shown). Also, sources of N did not influence yields from 1962 to 1966. Yields from 'Tifblue' plants receiving cottonseed meal tended to be higher than other treatments in 4 of the 6 years (Table 3). In the 6th year there were no yield differences among plants fertilized with cottonseed meal, azalea-camellia fertilizer and 5–10–10 commercial analysis. In general, these fertilizers averaged the best yields for the 6 years (Table 3).

Visual observations made in July 1964 indicated better plants in plots where cottonseed meal, 4–8–8 (4.0 N–3.5 P–6.6 K) or commercial 5–10–10 (5.0 N–4.4 P–8.3 K) fertilizer was applied.

In addition to cottonseed meal (7–2–2), during the first 2 years higher yields were obtained from those 'Tifblue' plants receiving just potassium sulfate. Regardless of the source of N, lowest yields were observed from those plants receiving only N or higher rates of N in comparison to P and K.

'Woodard' responded differently than 'Tifblue'. In 5 of the 6 years, some of the highest yields were obtained where no fertilizer was applied (Table 4). However, in each of the last 2 years, there were no differences at all among the fertilizer treatments. Two fertilizer treatments that gave good results

Table 3. Influence of fertilizers over a 6-year period on yield of 'Tifblue' blueberry plants.

N–P–K oxide ratio[z]	Yield (g/plant)					
	1961	1962	1963	1964	1965	1966
7–2–2[y]	805a[v]	1354a	1862a	1173abc	1715ab	2650a
1–2–2[x]	638ab	859abcd	1446ab	1534ab	2135a	2898a
1–2–2[w]	621abc	982ab	1678ab	1541a	1569ab	2772a
0–0–0	638ab	910abc	1371abc	982abc	866b	1678ab
1–0–0	181cd	317bcd	348cd	583bc	593b	897b
0–1–0	631ab	965ab	972abcd	897abc	621b	1449ab
0–0–1	774a	1255a	1678ab	1030abc	955ab	1777ab
1–1–1	559abcd	825abcd	1084abcd	1214abc	1841ab	2032ab
2–1–1	113d	123d	106d	316c	750b	989b
1–2–1	518abcd	914abc	975abcd	975abc	1596ab	1691ab
1–1–2	692ab	832abcd	709bcd	1003abc	1371ab	1920ab
2–2–2	283bcd	293bcd	314cd	702abc	1238ab	1633ab

[z]N source – data pooled from ammonium nitrate, urea-form and urea.
[y]7–2–2 Cottonseed meal.
[x]5–10–10 oxide ratio.
[w]4–8–8 Azalea-camellia fertilizer.
[v]Mean separation in columns by Duncan's multiple range test, 5% level.

Table 4. Influence of fertilizers over a 6-year period on yield of 'Woodard' blueberry plants.

N–P–K oxide ratio[z]	Yield (g/plant)					
	1961	1962	1963	1964	1965	1966
7–2–2[y]	419bcde[v]	720abc	1402a	1712a	1330a	1562a
1–2–2[x]	225de	191cd	426bc	910bcd	760a	1521a
1–2–2[w]	246de	348cd	662abc	825bcd	675a	1364a
0–0–0	1074a	1350a	1647a	1350abc	1344a	1323a
1–0–0	113e	140d	348bc	413d	433a	426a
0–1–0	597bc	675bcd	924abc	859bcd	774a	924a
0–0–1	762b	1316ab	1534a	1364ab	1449a	1494a
1–1–1	481bcd	760abc	1136ab	1350abc	1074a	1562a
2–1–1	170de	269cd	314c	617bcd	426a	641a
1–2–1	334cde	447cd	505bc	812bcd	754a	1050a
1–1–2	471bcd	668bcd	812abc	958abcd	805a	1009a
2–2–2	181de	184cd	191c	583cd	556a	1350a

[z]N source – data pooled from ammonium nitrate, urea-form and urea.
[y]7–2–2 Cottonseed meal.
[x]5–10–10 oxide ratio.
[w]4–8–8 Azalea-camellia fertilizer.
[v]Mean separation in columns by Duncan's multiple range test, 5% level.

over the 6-year period were potassium sulfate and cottonseed meal.

Soil pH of samples taken in 1965 ranged from 4.7 for plants fertilized with only urea-form to 4.1 for plants fertilized with 1–1–2; however, there were no significant differences in pH among treatments. The soil test level for P or K was low in all plots not receiving P or K.

'Tifblue' plants fertilized with cottonseed meal and azalea-camellia fertilizer were vigorous plants with good growth. In general, foliage was of a good green color in all fertilizer treatments containing N. However, each July, plants fertilized with only N turned a bright red color.

Discussion

Most fertilizer recommendations indicate that a complete fertilizer is necessary for maximum production of blueberries. However, there are conditions in which blueberry plants have grown best in acid soils low in nutrients (11, 19). This appears to be true for 'Woodard', which initially has fewer roots than 'Tifblue' (unpublished data).

Lilly (16) reported a good response of highbush blueberry plants to applied P but little response to N and K in North Carolina. He suggested a 1–1–1 ratio (oxide basis) if the soil test indicated a high P level and 1–2–1 ratio (oxide basis) if P was at low or medium levels. However, neither of the rabbiteye cultivars in our study responded to either ratio. This may be attributed to a deeper root system of the rabbiteye than highbush blueberry (unpublished data) or the differences in soil type and/or climatic conditions between the 2 locations in which these cultivars were grown.

Our data concur with those of Bailey et al. (1) and Townsend (19), which showed that heavy applications of ammonium sulfate decreased yields. Townsend (19) suggested a marked effect of N fertilizer on certain soil attributes since the application of ammonium sulfate decreased soil pH and contributed substantially to soluble salt content of the soil. Yields were closely associated with soluble salts content of the soil. On the other hand, Ballinger et al. (2) reported that increasing rates of N increased yield per bush and bush vigor but had no effect on fruit size. However, Brooks (7) and Townsend (19) reported that an increase in N application was associated with a decrease in fruit size. A balance of nutrients seems to be important since developing fruit drains heavily upon the leaves for water, sugars, acid and mineral elements (particularly K) (3). In addition, berries from plants receiving high rates of N fertilizer remove the greatest quantities of N, P, K and Mg per hectare

(4).

Young rabbiteye blueberry plants are very sensitive to readily soluble N fertilizers. If soils are in low fertility, caution should be taken as to the quantity and type of fertilizers used. As plants grow larger, the type and quantity of fertilizer applied must be determined by soil analysis and plant growth. It may be that all rabbiteye cultivars may not require the same fertilizer practice.

It appears that with a soil type such as a Leefield loamy sand, 'Tifblue' responds to 1–2–2 oxide ratio [4–8–8 (azalea-camellia fertilizer) and 5–10–10] and organic matter with nutrients (cottonseed meal). Fertilizers with 1–0–0 or 2–1–1 oxide ratios should be avoided with 'Tifblue'. 'Woodard' did not respond to any fertilizer treatment.

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Inheritance of Big Bud Mite Susceptibility in Filberts[1]

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Additional index words. Corylus avellana, Phytoptus avellanae, Phytocoptella avellanae, mite resistance

Abstract. **Susceptibility ratings for big bud mite *Phytocoptella avellanae* (Nal.) are given for 144 clones of filberts (*Corylus* sp.) and for 1850 progeny between crosses involving 21 parents. There is genetic resistance as well as different levels of susceptibility. Susceptibility is highly heritable and appears to be determined by multiple genes with predominantly additive gene action.**

"Big bud" in filberts is a well known problem in all commercially important regions of the world. It is considered to occur throughout the natural range of *C. avellana* L. in Europe and is found abundantly in the 2 native American species, *C. americana* Marsh and *C. cornuta* Marsh. The mite *Phytocoptella avellanae* (*Phytoptus avellanae* Nal.) has long been considered the sole causative agent. Recently Krantz (1) discovered that *Cecidophyopsis vermiformis* (Nal.) is also involved, although to a lesser extent. Feeding of the mite within both vegetative and reproductive buds results in cell proliferation which transforms the buds into greatly enlarged, often reddish-colored gall-like structures (Fig. 1). These dry and fall from the tree, thus depriving the tree of vegetative growth and potential nut development. Crops are reduced by moderate to severe infestations. From orchard experience in Oregon for many years, cultivars are known to have differential sensitivity or resistance to mite damage (3, 4, 5). For example, 'Daviana' is highly susceptible, 'Duchilly' is slightly susceptible, and the major cultivar in Oregon, 'Barcelona', is essentially resistant since only rarely can galled buds be found. In the breeding of new cultivars it is highly desirable to maintain this resistance. The exact mode of inheritance has not been reported. However, from observation of bud mite damage on parents and progenies, Ourecky and Slate (3) reported that susceptibility appeared dominant to resistance. The objectives of this report are 1) to present bud mite susceptibility ratings for cultivars and selections in the Oregon State Univ. filbert collection, and 2) to contribute information on the mode of inheritance of this trait.

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Materials and Methods

Bud mite infestation was evaluated on 144 cultivars at 3 sites in the Willamette Valley, Oregon. Plantings at Aurora and